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XX. *On the Civil Year of the Hindoos, and its Divisions ; with an Account of three Hindoo Almanacs belonging to Charles Wilkins, Esq.* By Henry Cavendish, Esq.

Read June 21, 1792.

THOUGH we have received much information concerning the astronomy of the Hindoos, we know but little of their civil year, and its divisions ; and what accounts of it we have received vary much from each other, owing partly, as will be seen, to different methods being used in different parts of India. As it occurred to me, that the best way by which a person in Europe could clear up the difficulties in this subject, would be to examine the *patras*, or almanacs, published by the Hindoos themselves, I applied to Mr. WILKINS, well known for his skill in the Sanskreet language, who was so good as to lend me three such, and assist me in finding out their meaning.

One of them was procured by Mr. WILKINS at Benares, and is computed for that place. The second came from Tanna, in the island of Salsette, near Bombay ; but it appears to be the copy of a Benares *patra*, as it is disposed in the same form as the first, and is adapted to the same latitude and longitude. The third is computed for Nadeea, a town of Bengal, about 50 miles N. of Calcutta, almost as noted for learned men as Benares, and much frequented by students from the coast of

Coromandel. The language of all three of them is a corrupt Sanskreet; but the last is written in the common Bengal character.

It appears from these almanacs that the civil year is regulated very differently in different parts of India; but before I speak of this year, it will be proper to mention a few words of the astronomical, which in all parts serves to regulate the civil year.

The astronomical year begins at the instant when the sun comes to the first point of the Hindoo zodiac. In the present year, 1792, it began, according to the principles delivered in the *Surya Siddhanta*,* on April 9, at 22^h 14' after midnight of their first meridian, which is about 41' of time west of Calcutta; but according to Mr. GENTIL's account of the Indian astronomy, it began 3^h 24' earlier. As this year, however, is longer than ours, its commencement falls continually later in respect of the Julian year by 50' 26" in four years.

This year is divided into 12 months, each of which corresponds to the time of the sun's stay in some sign, so that they are of different lengths, and seldom begin at the beginning of a day.

The civil day, in all parts of India, begins at sun-rise, and is divided into 60 parts, called dandas, which are again divided into 60 palas.

The only parts of the Benares patras which are of any material use for my purpose, are the names of the months which are set down at the top of each page, and the three first columns, the first of which contains the day of the month, according to the civil account, the next the day of the week,

* See an account of this in the 2d volume of the Asiatic Researches.

and the third the time at which the lunar *teethee* ends ; but as many may like to be informed of the nature of an Hindoo almanac, I shall give an account of the remaining parts at the end of this paper.

In those parts of India in which this almanac is used, the civil year is lunisolar, consisting of 12 lunar months, with an intercalary month inserted between them occasionally. It begins at the day after the new moon next before the beginning of the solar year.*

The lunar month is divided into thirty parts, called *teethees* ; these are not strictly of the same length, but are equal to the time in which the moon's true motion from the sun is 12° . From the new moon till the moon arrives at 12° distance from the sun, is called the first *teethee*. From thence till it comes

* My reasons for saying that the civil year begins at the day after the new moon next before the beginning of the solar year, are as follow: 1st. These almanacs begin at this time, and, moreover, the year of *Veekramādeetya* and *Sālavāhana*, which is set down at the top of each page, is the same in the first page as in all the following, which would be improper, unless the year began at this time. 2dly. In the calculation of the eclipse of the sun, in *PERE PATOUILLET's* *Memoir*, given in *BAILLY's* *Astronomie Indienne*, the computation is made for the new moon preceding the beginning of the solar year, and yet the year of *Sālavāhana*, and of the cycle of 60, set down in the *Memoir*, is the same as if the solar year was already begun. 3dly. *PERE DU CHAMP*, in his table of the names of the years of the cycle of 60, given in the same book, has added to some of them the corresponding year of Christ, together with a day of the month. This day, in all of them, is the day next after the new moon, preceding the beginning of the solar year: and though no explanation is given, must evidently be intended for the day on which the year begins. And, 4thly. It is said in the *Ayeen Akbery*, by *ABRAHAM ROGER*, and, I believe, some other authors, that the year begins at this time. To the three last authorities, indeed, it may be objected, that they are taken from places in which we do not know that the Benares almanac is used; but they shew, that in some parts of India the year begins at that time, and if it does so in any place, it most likely does at Benares.

to 24^o, is called the second teethee ; and so on till the full moon ; after which the teethees return in the same order as before.

The civil day is constantly called by the number of that teethee which expires during the course of the day.

As the teethee is sometimes longer than one day, a day sometimes occurs in which no teethee ends. When this is the case, the day is called by the same number as the following day ; so that two successive days go by the same name.

It oftener happens that two teethees end on the same day, in which case the number of the first of them gives name to the day, and there is no day called by the number of the last ; so that a gap is made in the order of the days.

In the latter part of the month the days are counted from the full moon, in the same manner as in the former part they are counted from the new moon ; only the last day, or that on which the new moon happens, is called the 30th instead of the 15th.

It follows from what has been said, that each half of the month constantly begins on the day after that on which the new or full moon falls ; only sometimes the half month begins with the second day, the first being wanting.

The manner of counting the days, as we have seen, is sufficiently intricate ; but that of counting the months, is still more so.

The civil year, as was before said, begins at the day after the new moon ; and moreover, in the years which have an intercalary month, this month begins at the day after the new moon ; but notwithstanding this, the ordinary civil month begins at the day after the full moon. To make their method more intelligible, I will call the time from new moon to

new moon, the natural month. The civil month Visākha begins at the day after the full moon of that natural month which commences at the beginning of the civil year, or, in other words, at the day after the full moon of that natural month during which the sun enters the first Hindoo sign. Jyēshtha begins on the day after the full moon of that natural month during which the sun enters the second sign, and so on. The names of the civil months, with the names of the signs which the sun enters during the natural month at the full moon of which the civil month begins, are given in the following table, to which I have also added the day of our month when the sun entered that sign in the latter part of the year 1784, and beginning of 1785, taken from the Benares almanac, the time of the day being counted from sun-rise, and expressed in the Hindoo manner.

Civil Month.	Sign.	Day on which the ☉ enters it.
		1784.
		day. dan. pa.
Visākha - - -	Mesha - - - - -	April - 9, 37, '7
Jyēshtha - - -	Vreesha - - - - -	May - 10, 34, 8
Ashāra - - - -	Meetona - - - - -	June - 11, 0, 8
Srāvana - - - -	Karkata - - - - -	July - 12, 37, 58
Bhādra - - - - -	Seengha - - - - -	August 13, 7, 11
Aswēena - - - -	Kanyā - - - - -	Sept. - 13, 7, 36
Kārteeka - - - -	Toolā - - - - -	Octob. 13, 32, 55
Mārgaseersha - - -	Vreescheeka - - -	Nov. - 12, 25, 38
Powsha - - - - -	Dhanoo - - - - -	Decem. 11, 54, 18
		1785.
Māgha - - - - -	Makara - - - - -	Jan. - 10, 13, 11
Phālgooona - - - -	Koombha - - - - -	Feb. - 8, 40, 21
Chitra - - - - -	Meena - - - - -	March 10, 30, 38

It may be observed, that in general, Visākha begins at the day after that full moon which is nearest to the instant at which the sun enters Mesha, whether before or after ; however, it is not always accurately the nearest.

The two parts of each month are distinguished in these almanacs by the addition of the syllables *vadee* and *soodhā* to the name ; thus the first half of Visākha, or that from the day after the full, to the day after the new moon is called Visākha-vadee, and the remainder Visākha-soodhā* ; but, I believe, the more usual way of distinguishing them is by the words *kreesbna paksha*, or the dark side, and *sookla paksha*, the bright side.

A consequence of this way of counting the months is, that the first half of Chitra falls in one year, and the latter half in the following year.

Whenever the sun enters no sign during a natural month, this month is intercalary, and makes an irregularity, which may best be explained by an example.

In the year 1779, the sun entered into no sign during the natural month which began at the end of the first fortnight of Srāvana ; accordingly the whole of this month was intercalary, and the fortnight which preceded it was called Neeja Srāvana vadee, instead of simply Srāvana vadee, as it would otherwise have been named. The first half of the intercalary month was called Adheeka Srāvana soodha, and the latter half Adheeka Srāvana vadee, and the fortnight after the intercalary month, Neeja Srāvana soodha.†

* *Soodha* signifies clear, pure, or complete ; but the word *Vadee* is not to be found in any of Mr. WILKINS's dictionaries.

† *Adheeka* signifies over and above, or intercalary. *Neeja* prefixed to the name of the month signifies that month itself.

It appears, therefore, that the two parts of the month where the intercalation takes place, are separated from each other by the interval of the whole intercalary month, and have the word Neeja prefixed to them ; and the two parts of the intercalary month are called by the same name, but have the word Adheeka prefixed.*

In these almanacs no notice is taken of the solar months, notwithstanding that a column is allotted to the day of the Mahometan calendar, which seems to shew that, in the countries which use the Benares patra, it is not customary to date by the solar month ; for it is very unlikely that the computers of these almanacs should have given the days of the Mahometan calendar, and yet have omitted days used in their own.

In those parts of India which use the Nadeea patra, the case is quite different. This almanac contains the name of the solar and lunar month, with the corresponding days of the week and solar month, and the number of the lunar teethee which

* What has been here said, agrees perfectly with Mr. WILKINS's almanacs ; the only doubt is, whether there may not be some different method of regulating the month, which may also agree with these almanacs, and may be the true one. It is proper, therefore, that I should state my reasons for the account here given. DU CHAMP, who seems a very accurate writer, says (see BAILLY, p. 320) that he was informed by a Hindoo calculator, that whenever the sun enters no sign during a lunar month, that month is doubled. This passage agrees very well with these almanacs, if by month we mean the time between two new moons ; but disagrees entirely with them if we mean by it the time between two full moons ; and moreover, in Mr. WILKINS's almanac it is the period from one new moon to another, which is called Adheeka. It seems certain, therefore, that in this passage the word month must mean what I have called the natural month ; and that the rule for intercalation is such as I have mentioned, namely, that it shall take place whenever the sun enters no sign during the natural month. It is certain also that the ordinary civil month begins at the day after the full moon ; and granting these two points, I cannot see any way in which the months can be regulated so as to differ in substance from what I have said.

ends on those days. It begins with the day after that on which the astronomical year commences. This is marked as the first of the month, the next day is called the second, and so on, regularly to the end of the month. In like manner, all the other months begin on the day after the astronomical commencement, and the days are continued regularly to the end, so that the number of days in the month varies from 29 to 32.*

* Perhaps I do not express myself accurately in saying that the civil month begins at the day after the commencement of the astronomical. It is true, that in this almanac it is the day after the commencement of the astronomical month, which is marked by the number one; but it must be observed that the Hindoos count by years complete, not by years current: for example, the year 1000 of the Kalee Yug begins at the time when 1000 years are completed from the Kalee Yug; and it is likely that the same manner of counting is adopted with regard to days, so that the day of the month marked one, does not signify the first day, but the day which begins at the expiration of the first day, and consequently that the civil month begins at the sun-rise of the day on which the astronomical month begins. I, however, have chosen to say that it begins at the day after, partly because I am not sure that the foregoing is the true meaning of the Hindoos, and partly because it would have been difficult to express myself in such manner as not to run great risk of being misunderstood, if I had done otherwise. What is here said applies equally to the lunar month in this and the Benares almanacs.

Though it is foreign to the subject of this paper, I cannot refrain from taking notice of an error, which I apprehend many European astronomers have fallen into, from not distinguishing between days current and days complete. It is common to say that the astronomical day begins twelve hours later than the civil day, and the nautical day twelve hours sooner; and it is true that the hour, which, according to the civil account is called one in the afternoon of the first of January, is written by astronomers January 1^d 1^h, but this, I apprehend, ought not to be read 1^h on the 1st of January, but 1^d and 1^h from the beginning of January, so that in reality the astronomical and nautical day both begin 12^h before the civil. A proof of the truth of this is, that in astronomical tables the place of the heavenly bodies set down for the beginning of the year, is the place for noon of the last civil day of the preceding year; and moreover, in HALLEY's tables this place is said to be *annis Julianis ineuntibus*, which shews that he thought that this was not merely a practice used for the sake of convenience, but that the year actually begins at this time.

The names of the months are the same as those of the lunar months in the Benares patra, Visākha being the first, or that which corresponds with the sign Mesha.

The lunar months begin, not at the full, as in the Benares patra, but at the new moon, and are called by the name of that solar month which ends during the course of them; for example, the lunar month, during which the solar month Visākha ends, is called Chandra (or lunar) Visākha, so that each month begins a fortnight later than by the Benares patra.

The teethees do not recommence at the full moon, but are continued to the end of the month, or to the goth. In other respects they are counted as in the Benares patra; that is, the same notation is used whenever a day occurs in which no teethee ends, or when two teethees end on the same day.

Unluckily no intercalary month occurred in the year for which this almanac was computed, so that it gives us no information about the method of intercalation; but from analogy we may conclude, that those lunar months in which the sun enters no sign are intercalary, and are called by the name of either the preceding or following month, with the addition of some word to denote that they are intercalary.*

As the Nadeea almanac begins with the day after the commencement of the solar year, and gives the day of the solar month, which the Benares patra does not, it affords reason to think that the custom of that part of India in which it is used, is to date by the solar month, and begin the year on the next

* The Chinese, who, like the Hindoos, consider that lunar month as intercalary in which the sun enters no sign, call it by the same name as the preceding month; and it is likely that the Bengalese do so too.

day to the astronomical year ; and accordingly Mr. WILKINS informs me, that the Hindoos of Bengal, in all their common transactions, date according to solar time, and use what is commonly called the Bengal era, but in the correspondence of the Brahmins, dating books, and regulating feasts and fasts, they generally note the teethee ; and if the year is mentioned, it is often that of Veekramādeetya, sometimes that of Sālavāhana, but more frequently the vulgar Bengal year.

From what has been said, it appears, that the Hindoo civil months, both solar and lunar, consist, neither of a determinate number of days, nor are regulated by any cycle, but depend solely on the motions of the sun and moon, so that a Hindoo has no way of knowing what day of the month it is, but by consulting his almanac ; and what is more, the month ought sometimes to begin on different days, in different places, on account of the difference in latitude and longitude, not to mention the difference which may arise from errors in computation. The inconvenience with which this must be attended seemed so great to me, that two or three years ago, by the assistance of Sir JOSEPH BANKS, I proposed a query on the subject to Mr. DAVIS, author of the very valuable paper, in the Asiatic Researches, on the Hindoo astronomy, inquiring whether any method was taken to avoid the ambiguity, and was favoured with the following answer.

“ My Pundit, and others with whom I have conversed on the
“ subject, although well aware of the circumstance (that the
“ month may begin on different days in different places) do
“ not think the ambiguity thence arising of much consequence,
“ nor is there any method they know of taken to avoid it.

“ The almanacs in common use are computed at Benares,
“ Tirhut,* and Nadeea, the three principal seminaries of
“ Hindoo learning in the Company’s provinces, whence they
“ are annually dispersed throughout the adjacent country.
“ Every Brahmin in charge of a temple, or whose duty it is
“ to announce the times for the observance of religious cere-
“ monies, is furnished with one of these almanacs ; and if he
“ be an astronomer, he makes such corrections in it as the
“ difference of latitude and longitude render necessary.

“ The beginning of the solar month falling on different
“ days of the week, is not, as I have observed, regarded ;
“ but a disagreement in the computation of the teethee,
“ which sometimes also happens, occasions no small perplexity,
“ because by the teethees, or lunar days, are regulated most
“ of their religious festivals: and I am assured that an in-
“ stance of this kind, which occurred in Cossim Ally’s time,
“ obliged the Rajah of Nadeea to settle by proclamation which
“ of the disputed computations should be regarded as the
“ true one.”

To the best of Mr. WILKINS’s knowledge, the Nadeea almanac is used all over Bengal, and the Benares all over the upper part of India: and it is likely, therefore, that the Tirhut is used all over Bahar ; but of the nature of this almanac I have no information ; only to judge from the date of the inscription found at Mongueer,† it is more likely to agree with the Nadeea than Benares patra.

As one of Mr. WILKINS’s Benares patras came from Salsette, we may conclude that this almanac is in use in that part of

* A district in North Bahar.

† Asiatic Researches, Vol. I. p. 127.

India. The inscriptions too, found at Salsette and Dehli,* confirm the opinions that this manner of dating is in use in both those places, as both are dated by the day of the bright side of the moon.

It appears from P. DU CHAMP, and P. PATOUILLET, and I believe I may add ABRAHAM ROGER, that in the part of India from which they write, the civil year begins at the new moon before the beginning of the astronomical year ;† which seems to shew that the Benares manner of dating is in use in great part of the coast of Coromandel ; but there is some reason to think, that in the neighbourhood of Madras and Pondicherry, they date in a manner different from that used either at Benares or Nadeea : for Mr. GENTIL makes the month Chitra or Sitterey, as he spells it, correspond with the sign Mesh, in which he agrees with an almanac published by an European at Madras, which seems to shew that in those places they date by solar months, but make Chitra correspond with the first sign.

Mr. WILKINS thinks he has heard of one or two places on the east coast of the Peninsula, and in particular Orissa, at which almanacs are computed ; but he is not acquainted with the nature of them.

I shall now give a more particular account of the three almanacs. The two Benares patras are preceded by a preface,

* Asiatic Researches, Vol. I. p. 363, and 379.

† Narsapour, from which P. PATOUILLET writes, is near the coast, and in the latitude of $16^{\circ}\frac{1}{2}$ N. Chrisnabouram, from which P. DU CHAMP's Memoir is sent, is in nearly the same latitude, but about 2° inland, and Paliacat, where ABRAHAM ROGER resided, is on the coast, in the latitude of $13^{\circ}\frac{1}{2}$, or near $\frac{1}{2}$ a degree N. of Madras. This author, however, has expressed himself so inaccurately, that I am not sure whether they begin the year at that time or not.

which begins with an invocation to the Deity, and then gives a whimsical account of the four Yoogas, or ages, and of the inferiority of each succeeding age to that preceding it, and concludes with astrological remarks.

There are no titles to any of the columns of which the almanacs are composed, nor is any explanation of them given in any part of the work ; but by a careful examination of the numbers, a person acquainted with astronomical computations may, without much difficulty, find out their meaning.

The calendar part contains one page for each half of the lunar month. At the top of each page is given the year of the eras of Veekramādeetya and Sālavāhana. After this comes the name of the month, and in one almanac is given also the name and number of the month used by the Mahometans.

The part below this consists of eleven columns. The first gives the day of the month, according to the civil reckoning ; the next the day of the week ; and the two following contain the time of the day, that is the danda and pala at which the lunar teethee ends. The fifth column contains the name of the nakshatra * which the moon quits during the course of the day ; and the two next shew the time at which she quits it.

The three next columns are very odd ; they serve to shew the moon's place in what may be called a moveable zodiac, the first point of which moves backwards with the same velocity with which the sun moves forwards, and coincides with the sun at the beginning and middle of the Hindoo year. This zodiac is divided into twenty-seven equal parts, and the

* Otherwise called the 27 lunar mansions.

first of these three columns gives the name of the 27th part which the moon quits during the course of the day, and the two others the time at which she quits it. I do not know what use these columns can be applied to, unless that of astrology. No trace of any thing of the kind has occurred to me in any account of the Hindoo astronomy*.

In these columns the names of the days of the week, and nakshatras, are expressed by the first syllable of the word.

The last column is the day of the month used by the Mahometans.

As no explanation of these columns is given in the almanacs, it will be proper to mention my reasons for supposing them to be such as I have asserted.

The numbers in the third and fourth column increase while the moon is near her apogee, and diminish during the rest of the month, which shews that it must be the time at which the moon completes some part of a revolution ; and by examining these numbers during twelve revolutions of the moon in anomaly, it appears that the moon moves over 336 of these parts in $330^d\ 41^{dan}.\ 43^{pal}.$ which differs very little from the time answering to 336 teethees, so that there can be no doubt but that these columns shew the time at which the teethee ends. But a further proof of the truth of it is, that the time given in these columns for the end of the last teethee of each half month, agrees pretty nearly with the time of the new and full moon given in the nautical almanac, after allowing for the difference of longitude between Greenwich and

* From a circumstance not worth mentioning, I find that the place of the moon in this moveable zodiac, is called the Yug.

Benares, and the time between sun-rise, at the latter place, and noon; which shews also that the time in these columns is reckoned from sun-rise, as might naturally be expected.

In regard to the moon's place in the nakshatras and moveable zodiac, it appears, by examining the fifth and eighth columns, that in each of them are 27 characters, which return constantly in order, except when the regularity is broken, either by the moon quitting two spaces in the same day, or by not quitting any one space in the day. The numbers also, both in the sixth and seventh, and in the ninth and tenth columns, increase when the moon is near the apogee, and diminish when she is near the perigee, which shews that they must be the time at which the moon finishes some 27th part of a revolution of one kind or other; and by examining the alteration of the numbers during twelve revolutions of the moon in anomaly, it appears first, that the moon describes 326 of the spaces given in the fifth column, in $329^d 57^{dan} 38^{pal}$ which is the time in which the moon moves over that number of nakshatras; and secondly, that the moon describes 350 of the spaces given in the eighth column in $329^d 36^{dan} 48^{pal}$ which is the time in which the sum of the mean motions of the moon and sun are equal to 350 27ths of a circle; or in other words, is the time in which the moon's motion in the moveable zodiac is 350 of these 27th parts; and moreover, I cannot find any other 27th of a revolution of the moon which will agree with this time; which is a sufficient proof that the numbers in the ninth and tenth columns are the times at which the moon quits one of these 27th parts in the moveable zodiac. But a thing which more strongly proves the truth of this, and which also shews that the first point of this

moveable zodiac coincides with the first point of the fixed zodiac, when the sun also coincides with it, is this: according to my supposition it is evident, that whenever the sun quits a nakshatra at the same time that the moon quits some other nakshatra, the moon must at the same time quit some 27th part of the moveable zodiac; and consequently that the numbers in the ninth and tenth columns should agree with those in the sixth and seventh; and accordingly we find, that on all the days of the year, in which the sun quits a nakshatra, the numbers in these two pairs of columns are nearly alike.

Underneath these eleven columns are tables of the diurnal motion and places of the sun and five planets, and of the moon's node in the Hindoo zodiac, for each week of the year; and between these tables and the eleven columns is set down the day of the month and week, and number of the week for which these places are given, and also the interval at that time between sun-rise and midnight, and the length of the day. The day of the week for which these places are given, is that which is the first in the current solar year, and the number of the week is also counted from the beginning of the solar year. The places are given for midnight.

On the right hand of the eleven principal columns is a space allotted for miscellaneous occurrences. In this is set down the time at which the sun enters each sign, and the beginning and end of eclipses. In these two years no solar eclipses were visible, but the end of the lunar eclipse is denoted by a Sanskreet word, signifying delivery; the meaning of the term used for the beginning is not so clear. The number of digits eclipsed is not set down. The other articles in

this space consist chiefly of the time at which the moon and planets come to certain situations. Of this there is not a great deal which I understand, and what I do, is not worth taking notice of. There are also some figures and tables between the preface and calendar, which, as far as I can find, relate only to astrology.

The Nadeea almanac contains, besides the articles above-mentioned, the time of the day at which the lunar teethee ends, the number of the nakshatra and yug (place in the moveable zodiac) which the moons quits on that day, and the time at which she quits them, besides a few occasional remarks. It is disposed in a much coarser manner than the Benares patra, as each page contains as many days as it will hold, so that the month seldom begins at the beginning of a page. It contains no preface, and no explanation of the columns. The days of the week are not denoted by the first syllables of the name, but only by a number, expressing their order in the week, which caused some trouble in finding what day was meant by these numbers ; but, by a variety of circumstances, I think it certain that the number 1 must denote Sunday.